EST 30th ANNIVERSARY ANNUAL MEETING

Nonconvulsive Status Epilepticus (NCSE): EEG-Guided Treatment Strategies

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NCSE

- There is no established and validated single test that can diagnose NCSE

- Reference standard is inferred from multimodal data: all clinical, para-clinical, EEG, laboratory, neuroimaging, therapeutic response, and final outcomes

Leitinger M, Lancet Neurol 2016

EEG Correlates of NCSE

- EEG value is indispensable in diagnosis of NCSE and distinguish non-epileptic events

- If the clinical presentation exceeds what can be expected from investigations this delineates a "clinical-investigational mismatch" which should prompt an immediate EEG to identify and treat any seizure activity or SE

Leitinger M, Epileptic Disorders 2025

Evolving

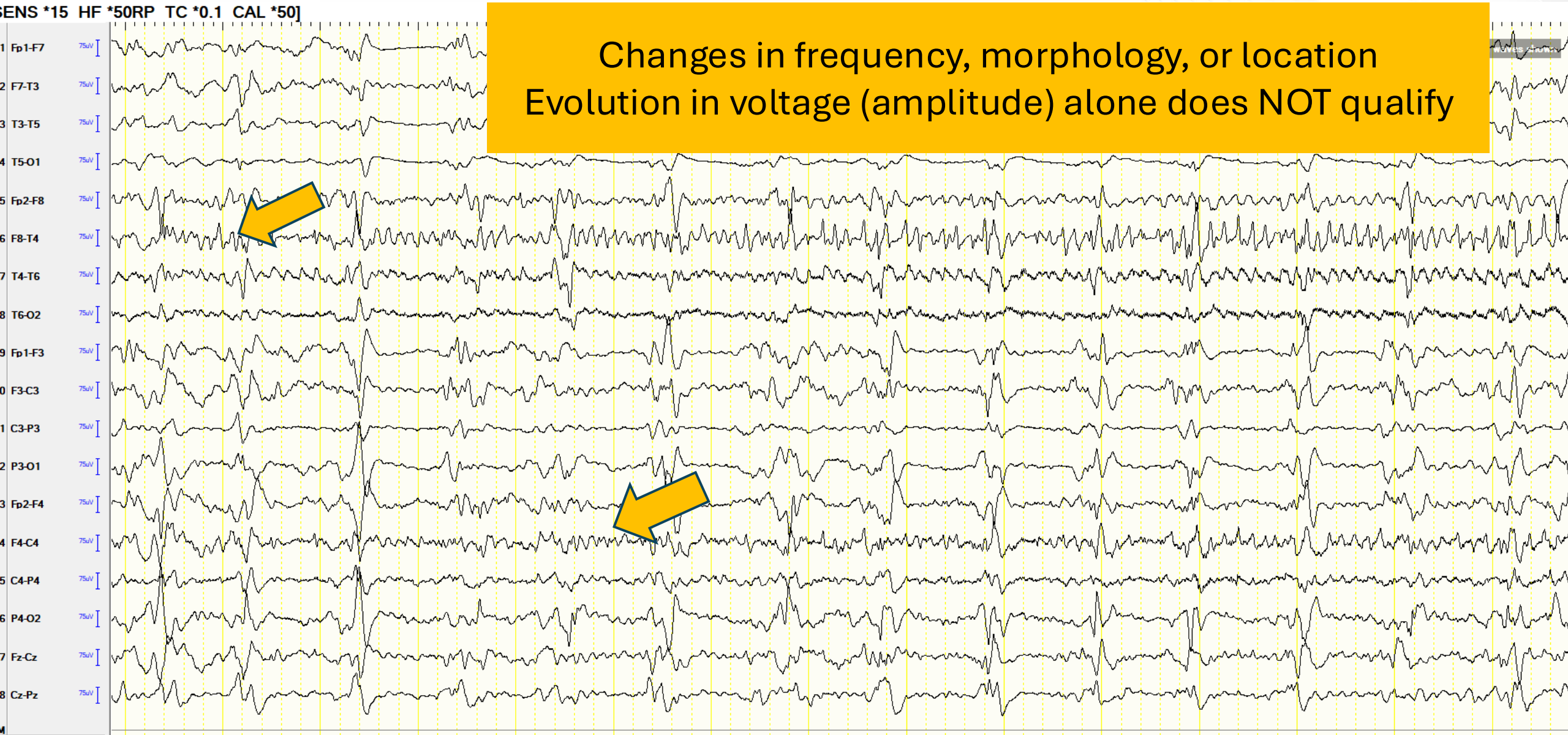
At least 2 unequivocal, sequential changes in frequency, morphology or location defined as follows:

- Frequency: ≥2 consecutive increases or decreases of ≥0.5 Hz, (e.g., 2 → 2.5 to 3 Hz, or 3 → 2 to 1.5 Hz)
- Morphology: ≥2 consecutive changes to a novel morphology
- Location: sequentially spreading into or out of ≥2 different standard 10-20 electrode locations

- NOTE:
  - if evolving and ≥10s: it's a seizure.
  - If evolving, 0.5-10s and reaches >4 Hz, it's a BIRD (definite due to evolution)
  - If evolving, <10s and never >4 Hz, just use the modifier "evolving", e.g., "very brief evolving RDA"

Hirsch LJ, ACNS Guideline, J Clin Neurophysiol 2021

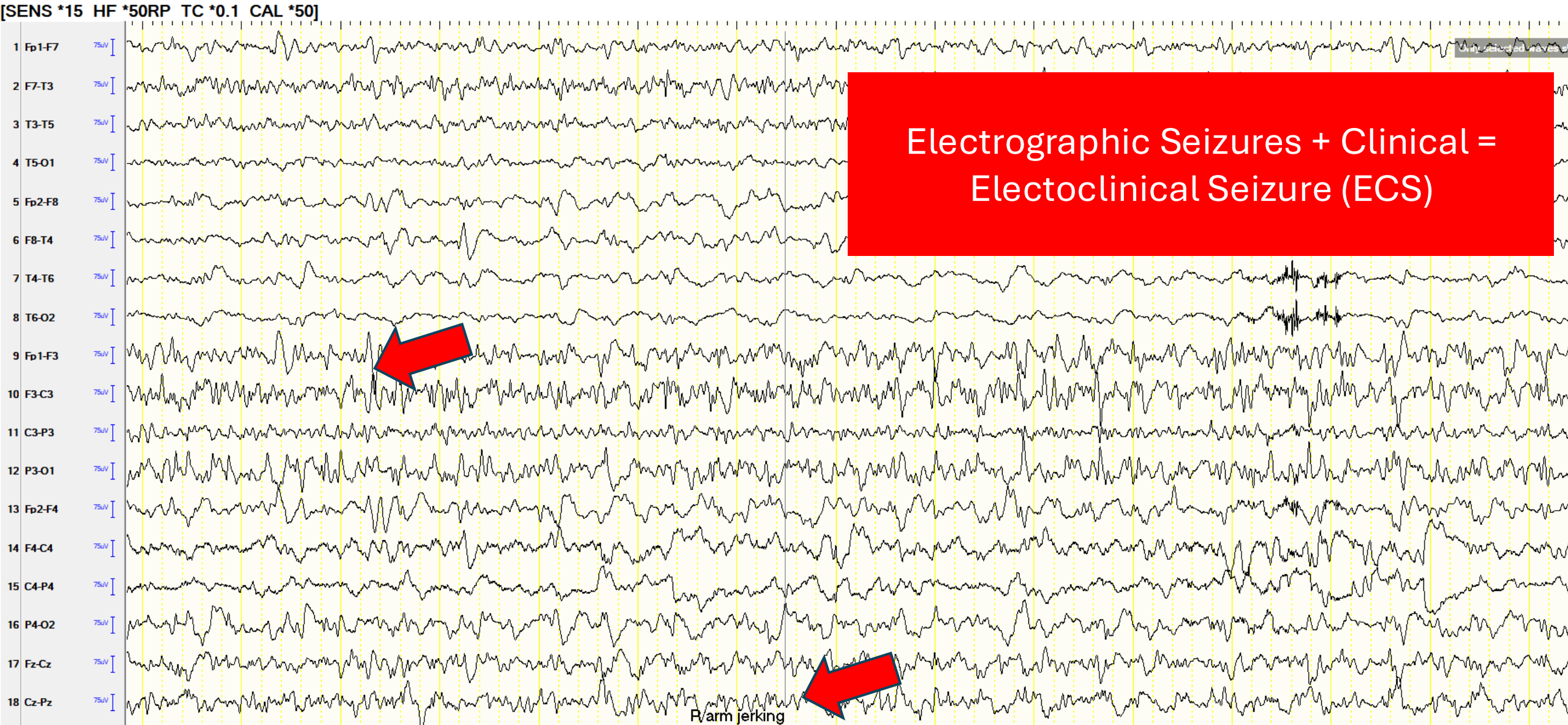
Evolution



Changes in frequency, morphology, or location

Evolution in voltage (amplitude) alone does NOT qualify

Terminology



Electroclinical Seizures

- **Electroclinical seizure (ECSz):** any EEG pattern with either
  - A) Definite clinical correlate time-locked to the pattern (of any duration), OR
  - B) EEG and clinical improvement with a parenteral ASM

- **Electroclinical status epilepticus (ECSE)**

Hirsch LJ, ACNS Guideline, J Clin Neurophysiol 2021

The Ictal-Interictal Continuum (IIC): possible NCSE

- A pattern that does not qualify as definite ESz or ESE
- There is a reasonable chance that it may be contributing to impaired consciousneess, causing other clinical symptoms, and/or contributing to neuronal injury
- Examples of pattern: PDs, RDA, SW not yet fulfiling the NCSE criteria

Leitinger M, Epileptic Disorders 2025

EEG and Clinical Improvement with IV ASM

- **A diagnostic trial with IV ASM** to assess EEG and clinical response as a criterion for definite NCSE or possible NCSE

- **EEG response:** IIC-free EEG interval ≥3 times the longest prior sponatneous IIC-free interval, minimum 1 continuous min

- **Clinical response:** improvement by ≥1 step on a newly created NCSE response scale (NRS) or time-locked improvement of ictal focal deficit

Leitinger M, Epilepsia 2023

Nonbenzodiazepine Medication for a Diagnostic IV ASM Trial

	LEV	VPA	LCM	PHT	PB
Starting dose (mg/kg)	40	30	6	15	10
Administration time (min)	5	5	10	15	15+
With additional boluses up to a max dose of (whichever is lower)					
Max total loading dose (mg/kg)	60	40	8	20	20
Max total loading dose, absolute (mg)	4500	3000	600	1500	1500
Special measures			EKG monitoring	EKG monitoring	

Modified from Leitinger M, Epilepsia 2023

Benzodiazepine for a Diagnostic IV ASM Trial

	Midazolam	Diazepam	Lorazepam	Clonazepam
If there is no EEG response, give incremental doses (same as starting doses) every 2-3 min (under EEG and clinical monitoring) up to a maximum dose of (whichever is lower)				
Max dose (mg/kg)	0.2	0.25	0.1	0.05
Max dose, absolute (mg)	5	20	2.5	1.25

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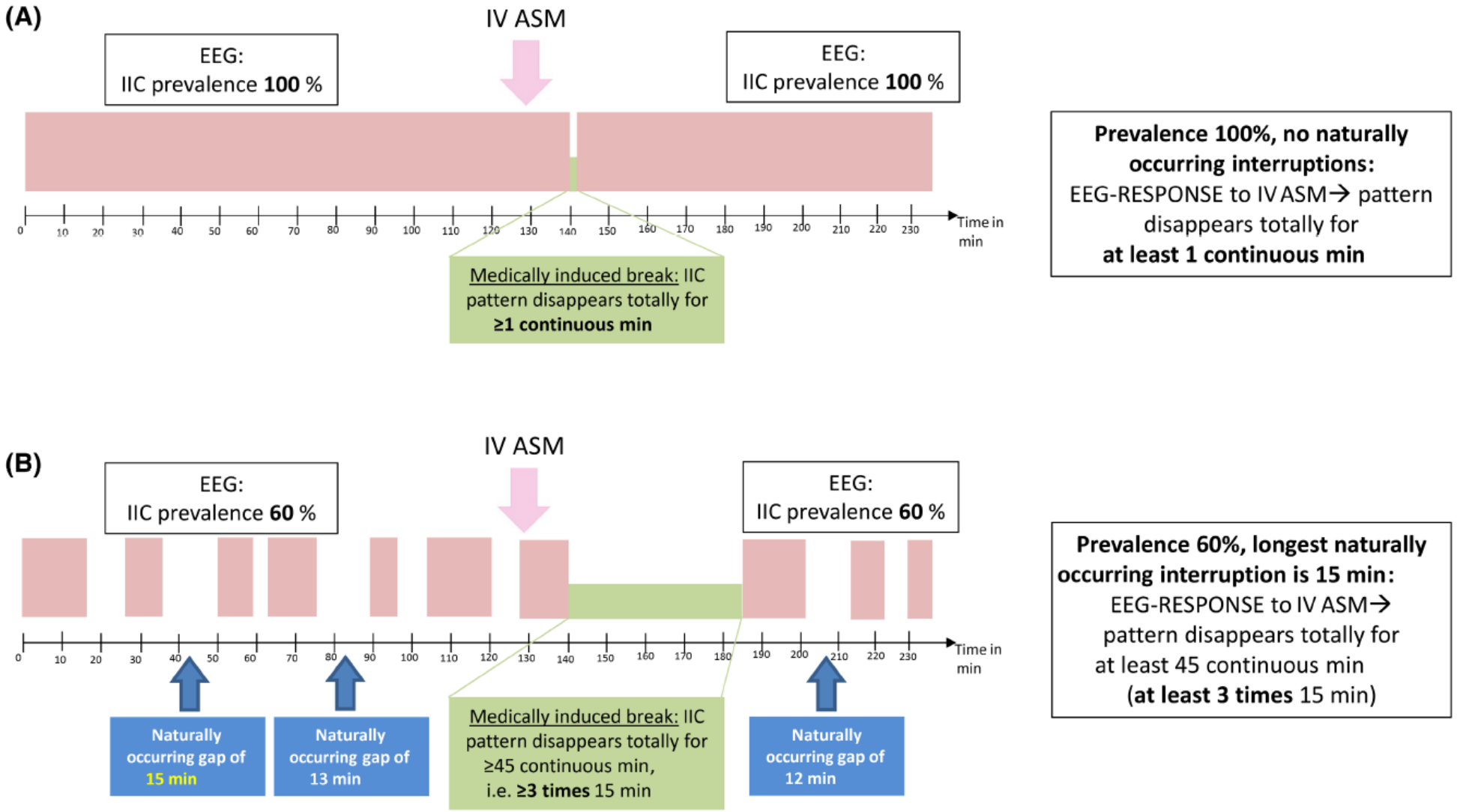
EEG Response to IV ASM



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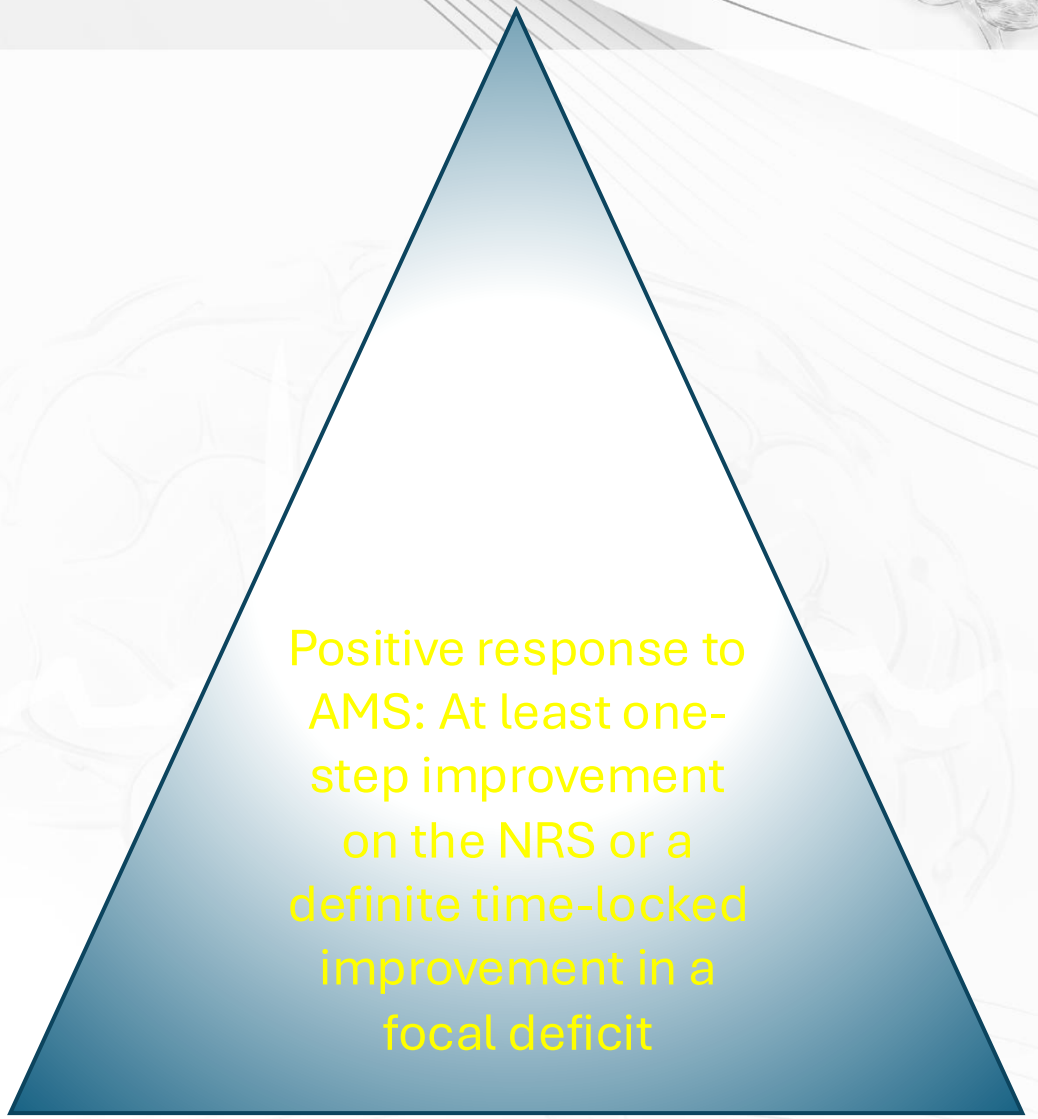
Clinical Response to ASM Trial: NRS Scale

Level 10: Normal
Level 9: Speaks or writes words with clear sense, oriented to person, year, and city or region, but behavior or performance different than normal
Level 8: Speaks or writes words with clear sense, but disoriented to person, year, and city or region
Level 7: Speaks or writes words or syllables, incomprehensible or confused
Level 6: Follows commands (verbally or by demonstration) (e.g., open/close eyes, raise arms, say "1, 2, 3")
Level 5: Directed gaze to examiner (or responsive vertical eye movement in locked-in syndrome), does not follow any commands (neither verbal nor by demonstration)
Level 4: Opens eyes spontaneously or to verbal stimulus or to light touch (no directed gaze), does not follow any commands
Level 3: Opens eyes to (strong) tactile stimulus (right or left shoulder, nose), does not follow commands (neither verbal nor by demonstration)
Level 2: Localizes to/wards off painful stimuli
Level 1: No purposeful response to painful stimuli



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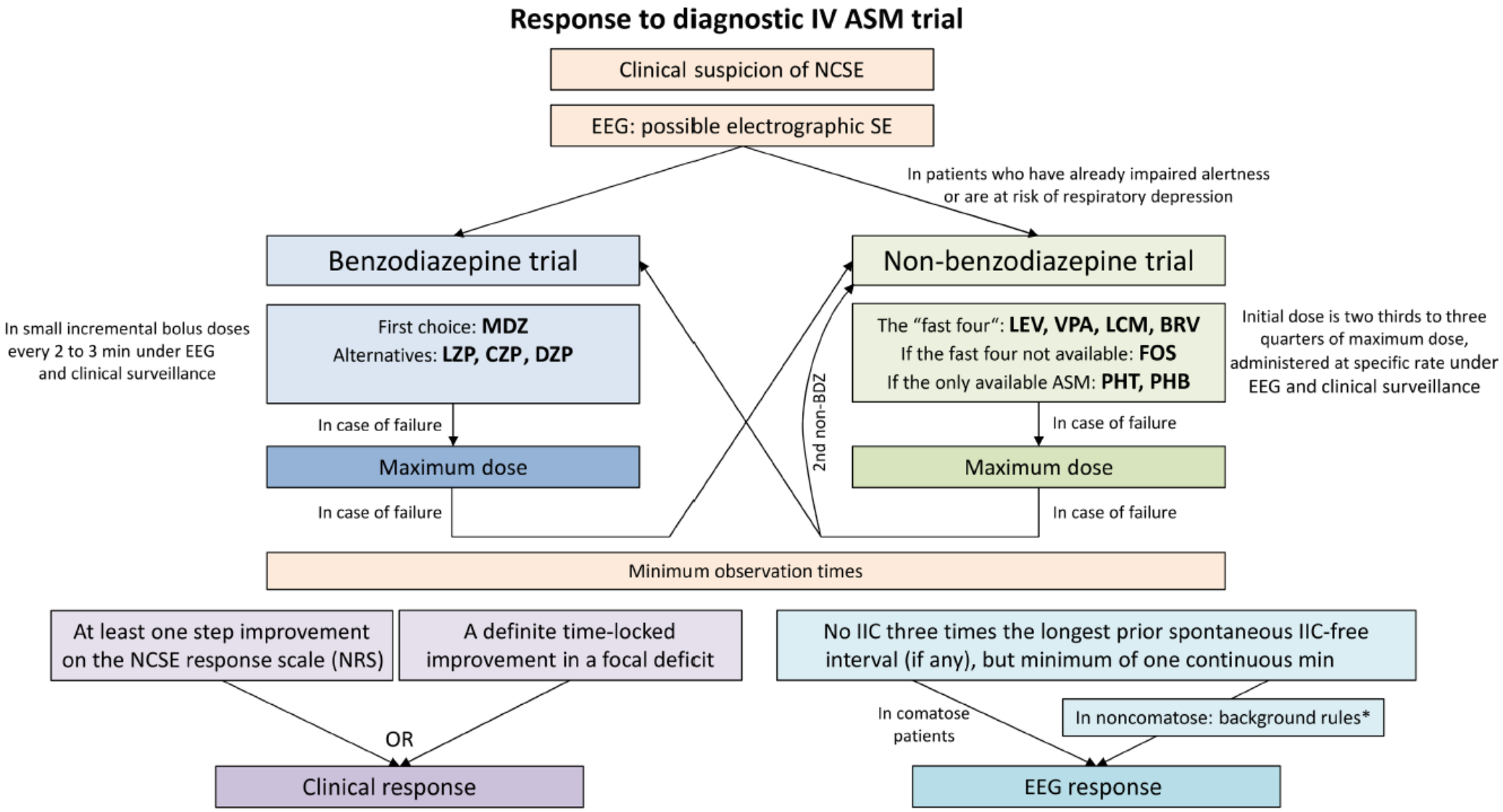
Overview of the Diagnostic IV ASM Trial Recommendation



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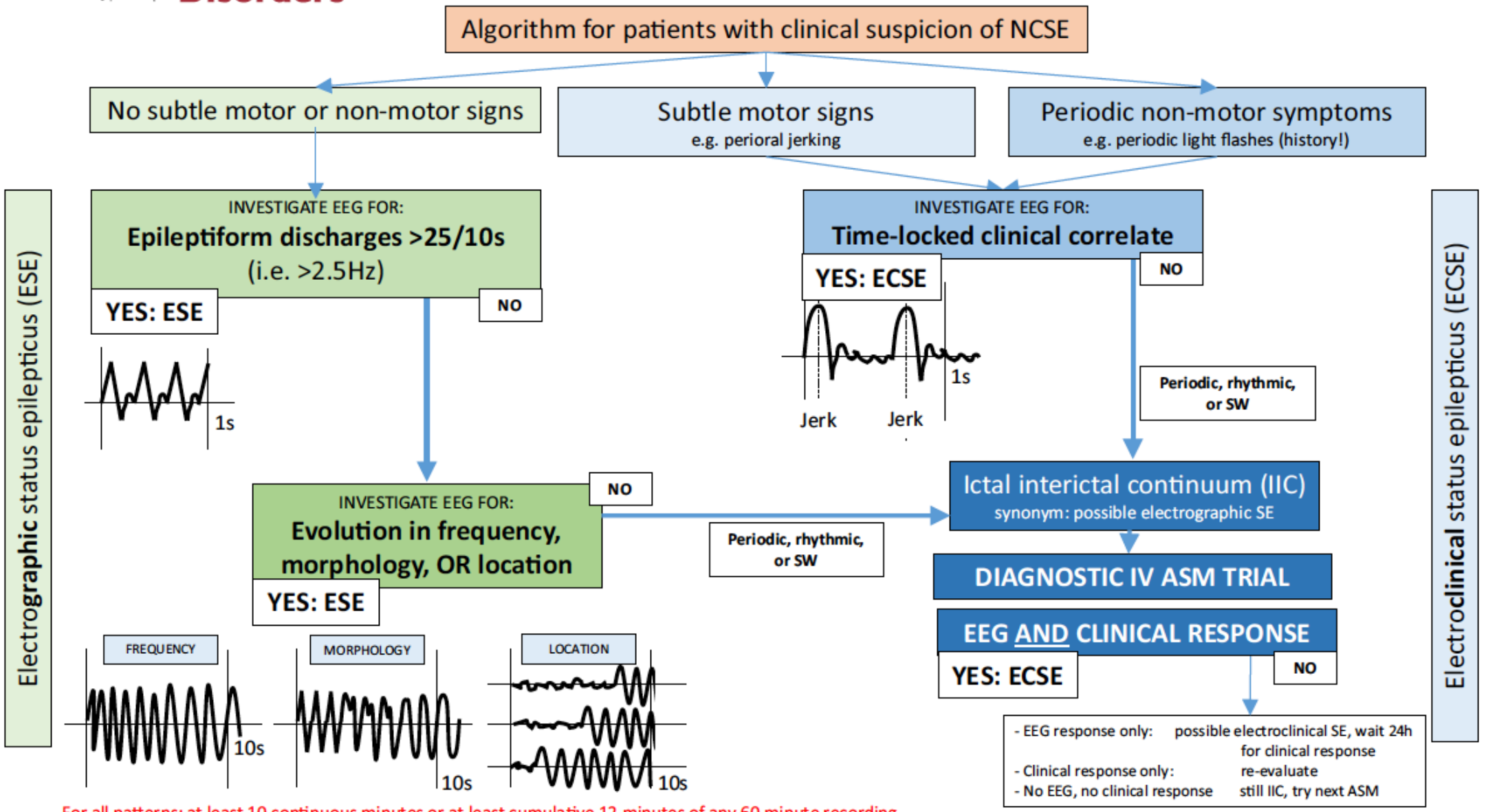
Overview over the diagnostic criteria of NCSEs without pre-exisitng encephalopathy



For all patterns: at least 10 continuous minutes or at least cumulative 12 minutes of any 60 minute recording

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Conclusions

- cEEG monitoring is indispensible for diagnosis of NCSE
- Seizure burden is independently associated with unfavorable outcome
- A diagnostic IV ASM trial is recommended in patients with possible NCSE


Thank You For Your Attention